Successful Methods

Construction - Road Making - Engineering - Industrial - Mining

September 1919

Tower Goes Up Ready for Work

LAKEWOOD CLAM SHELL BUCKETS

Cut Digging and Handling Costs

Bigger loads mean cheaper digging. Full loads every time cut costs to a minimum.

Lakewood Clam Shells are designed and built to get full loads every time—and they do it. The closing power increases as the lips come together. The Lakewood digs down as it closes—gets all it can hold and comes up filled to overflowing.

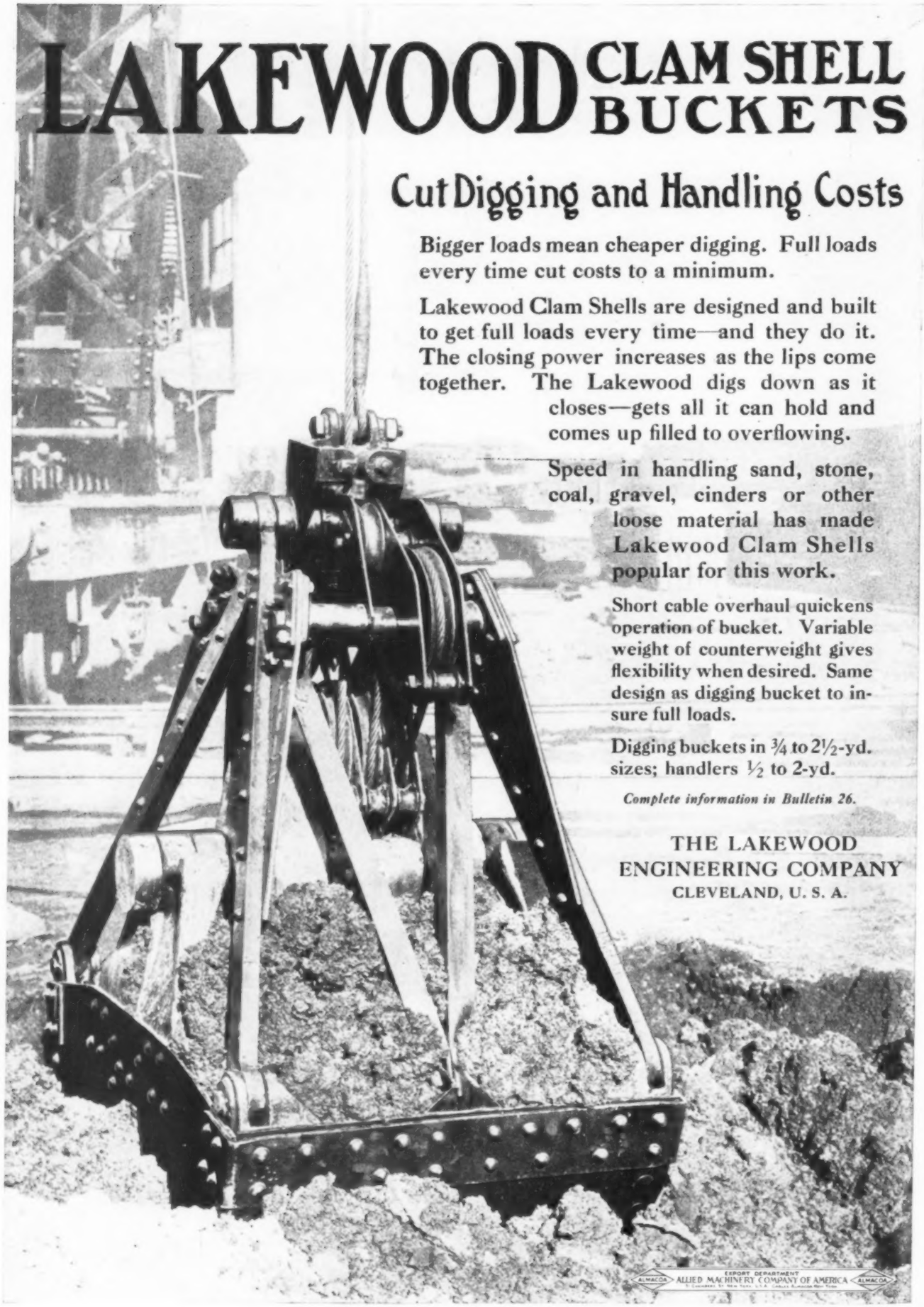
Speed in handling sand, stone, coal, gravel, cinders or other loose material has made Lakewood Clam Shells popular for this work.

Short cable overhaul quickens operation of bucket. Variable weight of counterweight gives flexibility when desired. Same design as digging bucket to insure full loads.

Digging buckets in ¾ to 2½-yd. sizes; handlers ½ to 2-yd.

Complete information in Bulletin 26.

THE LAKEWOOD
ENGINEERING COMPANY
CLEVELAND, U. S. A.



EXPORT DEPARTMENT
ALMACOA ALLIED MACHINERY COMPANY OF AMERICA ALMACOA

Successful Methods

A Magazine of Construction Service

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UNIT CONSTRUCTION PLANTS

"If people realized the slender thread upon which health and human life hang, they would be appalled," remarked a noted physician during the influenza epidemic. "The whole human body ceases to operate properly when a single part stops working."

The continuous and efficient operation of a construction plant hangs upon just as slender a thread. For the failure of a small part the whole plant frequently must be shut down, and if one machine in the plant does not fit smoothly into the general scheme of operation, the production of all the other machines is decreased.

Making a highway, a building, a bridge or a reservoir is the work of one machine—the unit plant. This plant may be composed of many different parts, such as mixers, shovels, wheelbarrows, hoists, lights, etc., but results are governed, not by what one part does, but by what the whole unit plant produces.

Heretofore the task of the proper selection of the individual plant units has been left to the contractor, but the burden of responsibility for the successful design of the plant as a whole rightfully belongs with the manufacturer. Thus contractors obtain the maximum benefits from the operation of the plant as a whole and are freed from many of the ills that usually attend plant operation.

Welding a construction job into a smooth running unit is essentially like developing factory production. To handle material more than the minimum number of times is to squander money. Useless machinery is a liability and one machine not adapted to the work cuts down the production of the whole plant. Manufacturers have valuable information—make use of it.

Construction service points out and demonstrates not only the function of each machine but the suitability of the plant as a whole to perform a given work quickly, economically and with the least expenditure of labor.

This Magazine Will Be Sent to Men Who Can Use It.

This issue has more than 50,000 circulation.

EDITORIALS

Revising Form of Highways Contracts

"IT is essential that the amount of work awarded in a single contract be large enough to attract contractors with large organizations and sufficient capital to install the mechanical equipment necessary for rapid construction. And if contractors with such qualifications are to be attracted to the work a greater latitude should be allowed them in handling sub-contracts. The general contractor should have an opportunity to plan the work."

The above quotation from the article by A. N. Johnson in this issue calls attention to a vital and timely problem of modern highway construction. Frank opinions of many highway officials are given.

Eleven state highway departments are unqualifiedly in favor of retaining the single contract system. Three are in favor of retaining it with certain provisions for letting sub-contracts. Six are in favor of adopting the double contract system and twelve approve separate contracts but qualify their approval by saying that there are many advantages in the single contract system.

The pendulum seems to be swinging toward a change in the present system of letting highway contracts.

Do Railways Own Highway Crossings?

A MAJESTIC railroad first forbade the crossing and then brought suit against a highway contractor for damages caused by hauling industrial cars along the highway where it crosses the railroad tracks. The industrial cars are used in hauling material for a concrete road that crosses the railroad tracks.

Must highway officials limit the traffic on the roads to suit the convenience of the railroads, or must the railroads provide a crossing adequate to care for the traffic? That is the question.

Railroads are most important to the economic welfare of the nation, but are not highways also important? There has been too great a disposition on the part of railroads to look upon highway crossings as a nuisance to be suppressed rather than as an aid to their business. Do not these same crossings frequently lead to freight stations and serve the traffic artery that brings business to the railroads?

In the case of drainage ditches the courts have decided that the railroads may not interfere. Is not a highway just as important to the welfare of the countryside?

Light Railroads Near Highways

SUPPLEMENTING the discussion of the desirability of constructing light railways in this country, the following abstract of a decree signed in May, 1919, by Alfonso, King of Spain, is of interest.

The great difficulties in handling and the very high handling charges necessary to move manufactured products from the output place,—manufacture or field—to the large communication ways: highway, railway or shop, are very prejudicial to the development of the country's interests.

All these difficulties would be lessened, and in many cases they would practically disappear, if some facilities for the temporary or definitive installation of light railway cars would be given. These railways can be installed in a few hours, and generally without many changes in the ground.

Additional railway cars, would improve considerably the national economy and they would be very useful as complementary equipment for the auxiliary works of common roads and general railways, or works of harbors and channels.

To give more facilities than those arising from our Public Works legislation the undersigned Minister has made up the following decree which he has the honor to submit to Your Majesty for consideration.

Yours respectfully,
(Signed) ANGEE OSSORIO.

The instructions contained in the Royal Decree may be summarized as follows:

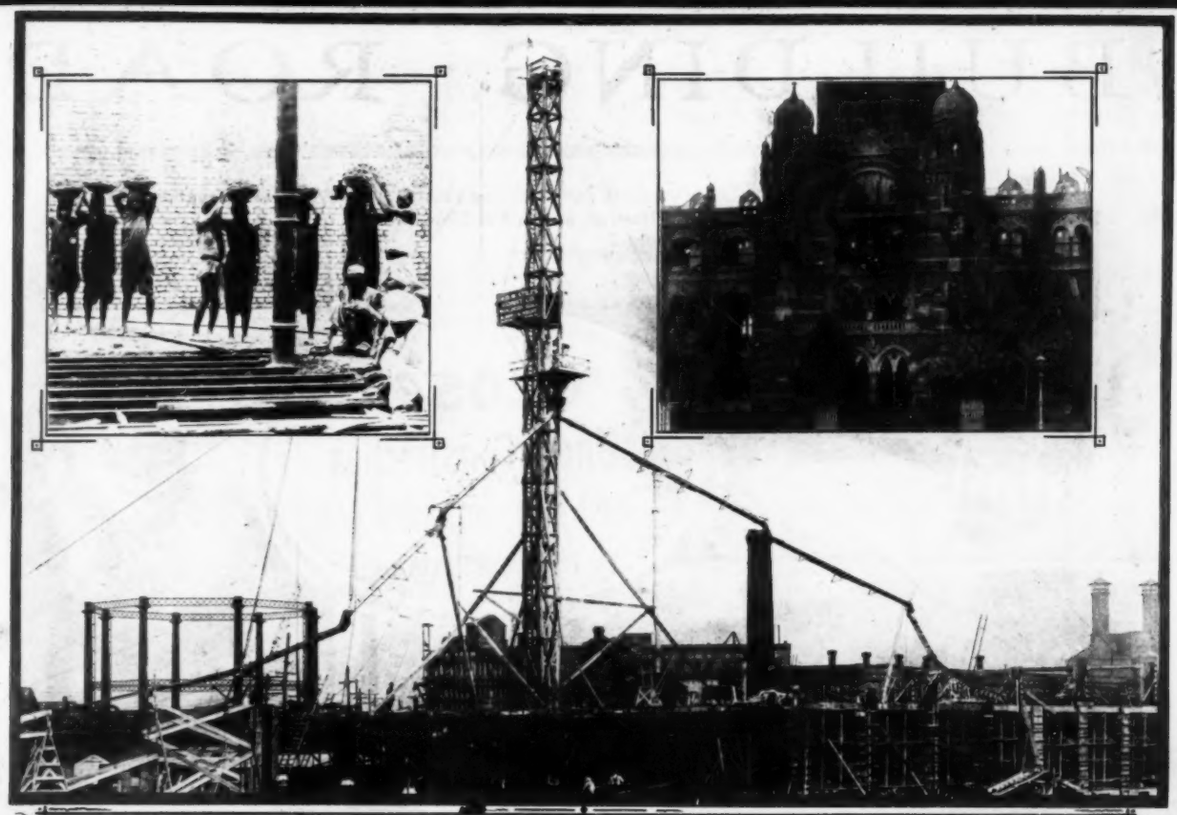
Portable railways can be installed on temporary or permanent right of ways to provide access to railroads, canals, harbors, wharves and highways. These railways shall have the character of works of public utility, and may be upon either public or private property.

Those intending to establish a portable railway must file with the Civil Government of their provinces profiles of the road and the names of the property owners affected. Public Works engineers shall investigate the feasibility of the project and if accepted, shall publish a statement of the proposed work for a period of 8 days. At the end of this time the Governor shall decide upon the necessity for a railway.

Property holders will be compensated and a railway established on a temporary basis may be made permanent after hearing the Public Works Council and upon request of the Civil Government of the province.

Camps De Luxe

THE modern city dweller can well envy the rich fare of the mule skinner and the traction engine driver in Minnesota. All the good things that a hungry man could wish for are supplied to the men in the camps. Cakes, pies, sirups, doughnuts, fruits and all other sweet things that go to make up a first-class menu were served at the meals, besides the usual supply of meat, vegetables and drinks. The editor did not want to leave.



Two Ways of Laying Concrete Floors. Women Laborers Carrying Concrete for the Bombay Post Office Shown Above. Compare This Ancient Method with the Spouting Plant Used on a Modern American Building.

Two Wrecks Caused by the Collision of an Automobile and a Railroad Train. A Portable Light Dispels the Darkness and Aids in Restoring Normal Traffic.

BUILDING ROADS

Gravel crushing and screening plant with conveyor from pit installed in Minnesota.

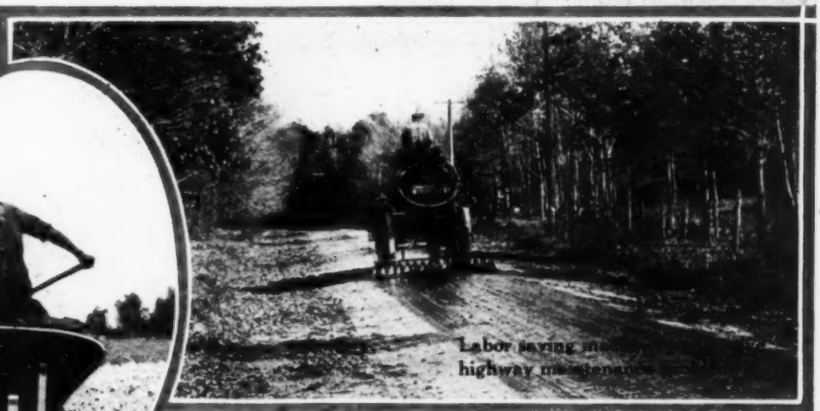
Cleaning the mixer—a job that is frequently neglected.

A sign that tells a story of modern progress.

The most economical method of side hill grading. Doing the whole job with a steam shovel.

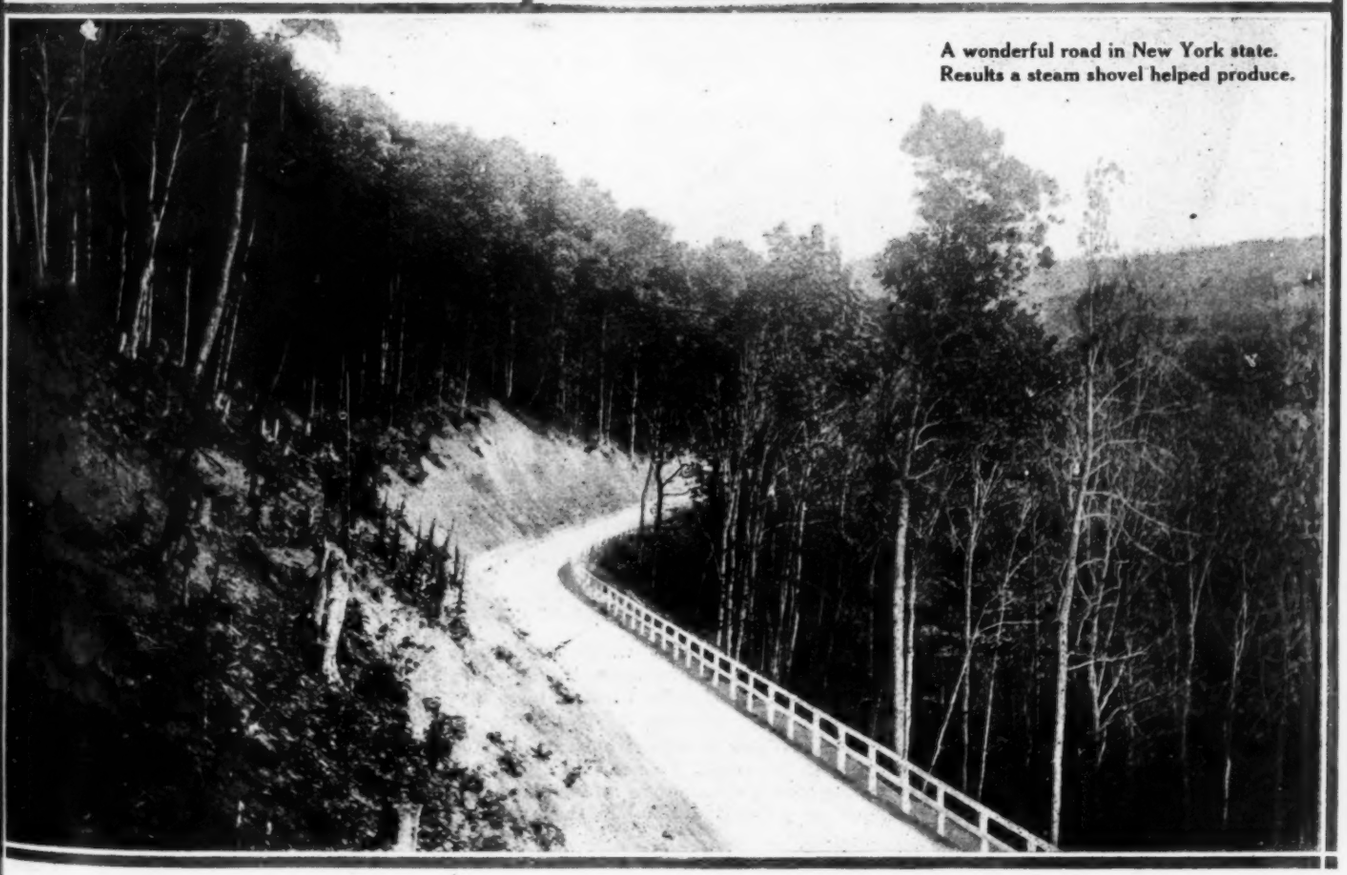
WITH MACHINERY

Modern methods of handling materials by light railroads reduce labor costs.



Labor saving ma… highway ma…

Modern asphalt pavements …uire thorough rolling.



A wonderful road in New York state. Results a steam shovel helped produce.

AMERICAN METHODS

The Wheat Elevator Terminal at Sydney, Australia, will be the largest grain elevator in that country and the first one of concrete. Last year two engineers representing H. Teesdale Smith, one of the largest construction operators in Australia, spent several months in the United States investigating construction methods. As a result American methods and machinery were adopted for this work.

Material is handled by a 60-ft. boom traveling derrick from cars or stockpile to the feeder on the traveling belt conveyor, thence by other conveyors to the bins. Two towers 210 ft. high were built complete on the ground and raised in position by means of cables attached to hoists and locomotives. Mixers will be located under the bins. The bins and towers are arranged for moving on skids as the work progresses.

TWO COOKS, OR ONE?

Should Contracts for Grading Upon Extensive Highway Improvements Be Awarded Separately?

By A. N. Johnson
Consulting Highway Engineer, Portland Cement Association.

WILL it be possible to get contracts for highway work without taking the grading? This question, recently asked by a contractor of large resources, suggested to the author that some information on the subject would be of value. Like many others at present, this contractor enters upon highway construction for the first time. The immense amount of work to be done in this field offers unprecedented inducement for contractors with sufficient capital and large organizations to bid for the larger highway offerings.

The paving proper constitutes by far a larger portion of the money value of such contracts. It is the part for which special machinery and equipment may be employed that would make the hazards and delays that occur, when the work must be done by hand labor and teams, a practical minimum. Thus, if a contractor is awarded a contract for 20 to 50 miles of road, he installs material storage and handling equipment, tracks and power-hauling outfits so as to reduce to almost nil the human or animal muscle power required.

Mr. Johnson can well be called the engineer father of the concrete road, since he was the first engineer to grasp fully the possibilities of this material. As chief engineer of the U. S. Bureau of Public Roads and later as state highway engineer of Illinois, he trained many men who have since accomplished great things in the field of highway construction.

This holds true so far as laying the pavement itself, but it is not so apparent that similar advantageous methods are afforded to handle the grading. Upon this part of the work a contractor secures few or no advantages merely because he is awarded a large mileage in a single contract. And so it comes about that some contractors desire to be relieved of the earth and other work preliminary to laying the pavement.

What Some State Highway Engineers Think

In order to ascertain the opinions of the state highway engineers upon the question of handling grading contracts, a letter upon the subject was addressed to each. The replies received contain much that is pertinent and disclose so clearly what effect various conditions have upon the methods now pursued that a review of them will aid both engineers and contractors to approach this problem. Of the replies received there was about an equal division of opinion between letting a single contract to include grading and paving and letting separate contracts for each of these portions of the work.

The reasons generally advanced for letting single contracts for grading and paving are:

1. Avoidance of delays and conflicts that would arise between different contractors on the same work.
2. Less inconveniences sustained by the public due to the lesser mileage of roads that would be torn up.

Perhaps excerpts from two of the letters that bring out these points are sufficient. Col. W. D. Uhler, Chief Engineer of the Pennsylvania State Highway Department, states that:

"In letting separate grading contracts it means that the paving contractors cannot go on with their work until the entire grading is cleaned up, whereas under the present method, by the time the average contractor completes his grading on the job, the paving is from 50 to 75 per cent completed.

"You can plainly see that there would be a great loss of time, were we to follow this practice. Our people want the roads and are willing to pay a fair price for them.

"As far as a scarcity of contractors is concerned, we have not experienced this condition, as we have been able to let everything advertised up to the present time, at what we consider a fair price to both the State and the contractors. I think this is plainly evidenced by the large program which we have under way, being far greater than anything undertaken by any other states up to the present time."

The following comment is made by Clifford Older, Chief Engineer of the Illinois States Highway Department:

"In regard to the awarding of contracts for the grading of country road work separate from the pavement proper, doubt if we would secure much better competition under such a division. I realize there are a number of contractors who do not care to do the culvert or earth work in connection with pavement construction; however, there are a large number of small contractors who do not care to do the pavement work and are always desirous of subletting the earth work from contractors who take the entire work.

"There seems to be more or less confusion where two or more contractors have contracts for a specific piece of road improvement, as very frequently the grading or culvert contractor delays the pavement contractor. In many cases, we find that it is much more convenient to build the side road culverts after the grading is completed and the pavement laid or at the same time the pavement is being laid.

"I believe that with the mechanical devices which are being perfected for grading, there will be less objection every year raised by contractors on account of the grading work. Where the grading can be done by machinery, we believe it will prove to be more economical and more satisfactory to all concerned for a single contractor to take both the earth work and the pavement construction."

Machinery a Practical Solution

The last paragraph of Mr. Older's letter is significant as it points the way to a practical solution of much of the difficulty some contractors experience with grading. Small tractors have successfully taken the place of teams for scraper and wheeler work. This constitutes a very large percentage of all grading for highways. There are to be sure some instances, particularly in hilly and mountainous districts, where comparatively heavy work is encountered, admitting the use of steam shovels. But, these

may be considered as exceptional and aside from the prevailing conditions which are here discussed.

The state highway departments which express themselves in favor of single contracts for grading and paving are Maine, Massachusetts, Connecticut, Rhode Island, New York, Maryland, Nebraska, Minnesota, Tennessee, Montana, Utah, New Mexico, Oklahoma and Texas. The departments of Oklahoma, Maryland, and Texas each make the suggestion that contracts be so drawn that the general contractor is not only permitted but encouraged to sublet the grading. This opinion is well summed up in a letter received from J. N. Mackall, Chief Engineer of the Maryland Road Commission.

"What I believe would be productive of the best results," Mr. Mackall remarks, "would be to specify that the grading and drainage work could be sublet to other contractors and to encourage rather than discourage, as is done at present, the matter of subletting a portion of the work. If the work were sublet, we would then have a general contractor to hold responsible for its prosecution, and there would be no claim on the commission for additional compensation due to extra work brought about by lack of cooperation."

The Arguments for Separate Contracts

The arguments presented in favor of separate contracts for grading and paving are:

1. Allows fills to settle before paving is placed.
2. Better prices can often be obtained with separate contracts.
3. Will make available local contractors equipped to do only grading.

Among the replies that expressed approval of separate contracts a considerable number did so qualifiedly believing there are also advantages for letting combined contracts. Such expression of opinion was received from the departments of New Hampshire, New Jersey, Wyoming, Kentucky, South Carolina, Indiana, Missouri, Kansas, South Dakota, Idaho, Nevada and Oregon; while the departments of Delaware, Michigan, Iowa, Alabama, Arizona and Washington are more positive in their recommendation for separate contracts for grading and paving. Frank F. Rogers, State Highway Commissioner of Michigan, states these arguments concisely.

"I wish to advise," he writes, "that this department is heartily in favor of letting contracts for the grading of roads separately from the paving. We prefer wherever possible, to let grading contracts along in the season where it is possible to finish them, and let the grade settle through the winter, then the following spring start the pavement.

"At the present time we have about half a dozen such instances, and I do not think we will be subjected to any criticism for proceeding along such lines. We surely get a better pavement in the long run.

"I am also of the impression that most paving contractors favor such a procedure. In many cases, grading is the longest part of a contract in point of time. Many contractors have advised me that they prefer to take straight paving contracts where the grading has already been completed and only fine work on the subgrade and shoulders remains to be done.

"I might say that we are soon to undertake the construction of the balance of the road between Ann Arbor and Jackson on the Detroit - Chicago Paved Way, amounting to about 25 miles in length. We intend to let separate grading contracts this fall for the grading and drainage structures. The grading on this road is extremely heavy, and I believe it is of the utmost importance that the grading be allowed to settle through one winter, if possible."

It is evident that there is a considerable difference of opinion. But from the somewhat conflicting data there are to be discerned certain facts that may be presented.

First, the problem has arisen because of essentially changed conditions. These are brought about by the desire on the part of the public to have completed, in the shortest time possible, extensive highway improvements, and, as an evidence of the sincerity of such desire, have voted bond issues of sufficient magnitude to complete, not only a system of improved highways for a county but for an entire state.

Those states not now confronted with such conditions (though from present indications these will soon be in the minority), do not have this problem for immediate solution. But there are a number of states and many counties now facing the construction, in the next few years, of an extraordinarily large mileage of modern highways. The engineers and contractors in charge of these undertakings will have to meet the problem of handling the grading so as to obtain the best results.

Select Method that Fits Local Conditions

Needless to state there probably is no one general method of procedure which will be found to answer all of the varied conditions that must be fulfilled. But some of the factors that should be considered may be pointed out.

It must be evident that past experiences based upon a number of small contracts, scattered over a whole state, can scarcely be a sufficient guide by which to handle work involving hundreds of miles of improvements in long continuous stretches.

Whether the grading and paving are let separately or not a great advantage is gained if the fills can be made and allowed to settle over the winter before laying the pavement. There must of necessity be some added inconvenience temporarily experienced by the public but which can be overcome in no small degree by carefully planned detours, and the construction of temporary side roads.

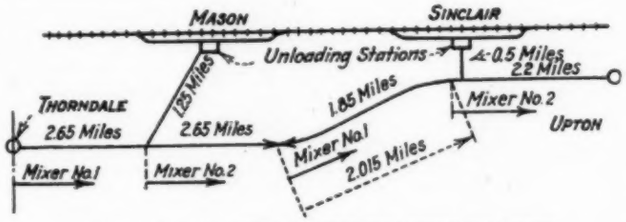
The use of machinery, particularly of small tractors, to take the place of teams for road grading may offer some relief to contractors who are ready to take large contracts but are fearful as to how they can handle the grading if they are obliged to rely upon the customary methods of the past.

It is essential that the amount of work awarded in a single contract be large enough to attract contractors with large organizations and sufficient capital to install the mechanical equipment necessary for rapid construction. And if contractors with such qualifications are to be attracted to the work a greater latitude should be allowed them in handling sub-contracts. The general contractor should have the opportunity to plan the work so as to be not only of an advantage to himself but so as to obtain the best results for the public.

ESTIMATING PLANT FOR RAIL HAULAGE

Plant Requirement Estimate for 9⅓ Mile Concrete Road Job—Crane Unloader Used—Tunnel Loading

THE form of estimate used for a 9⅓-mile concrete road job is given in this article. Each job must be considered independently and conditions are usually quite different on each job, but the general method and form shown has been successfully used and is worthy of study. This is an actual estimate, the names and prices only being omitted. The estimate form includes only those items necessary in determining plant requirements after an examination of the site.



TRACK AND UNLOADING STATION LAYOUT

The road was to be completed in a single working season. The cross-section used and the unloading points and track layout are shown in the figures.

Use a 3-ton gasoline locomotive hauling 10 car trains. A 10-car train is the most economical to use because of the greater speed obtained and the fewer dead cars produced. Experience has proved that short trains and light locomotives are far better than long trains and heavy locomotives. Moreover since 2 mixers are used, the train equipment is based on the greatest average haul and a speed of 8 miles per hour. Mixers are assumed to turn out 30 batches per hour.

The average haul from Mason is 2.55 miles and from Sinclair is 1.6 miles.

TRAIN SCHEDULE

	Arrive at Material Yard	Leave Material Yard	Arrive Mixer	Leave Mixer
No. 1	7.25	7.40	8.00	8.05
No. 2	7.45	8.00	8.20	8.25
No. 3	8.05	8.20	8.40	8.45
No. 1	8.25	8.40	9.00	9.05

For the 5-mile section hauling from Mason 3 trains in transit and 1 train at mixer are required for each mixer, or a total of six 3-ton locomotives and 80 road cars of ¾ cu. yd. capacity.

For the 4 miles section being fed from Sinclair a schedule providing the same number of trains must be used but the schedule may be slower.

Since each mixer will easily place 135 cu. yd. of concrete per day or the two mixers will place 270 cu. yd. of concrete, and the entire job totals 21,000 cu. yd. of concrete, 78 days of 9 hrs. each are needed. Allowing 16⅔% for delays due to heavy rains, or consider 5 days of work per week, 18 weeks are required for completion of job.

HAULING PLANT, WEIGHT AND OPERATING COST

Estimate: 1,492 15-ft. track sections, 318 lb. each; 15 ½ turnouts complete, 1,080 lb. each; 6 7½-ft. straight sections, 181 lb. each; 24 7½-ft. curved sections, 185 lb. each; 6 3-ton locomotives, 6,000 lb. each; 80 ¾-yd. road cars, 1,210 lb. each; and 4 doz. pairs splice bars, 72 lb. each. Total weight, 6,292,270 lb.

Estimate: 1 train superintendent, 6 engine runners, 2 track repair men and 5 bin gate men for 78 days. Laying and taking up 12 miles of track; freight; unloading 315 tons; 16 2-3% depreciation for track; 20% depreciation for cars; 25% depreciation for locomotives; 6% interest on hauling plant; 5% repairs on cars and locomotives; and total.

Ton Miles: 1 cu. yd. concrete weighs 2.013 tons.

$9{,}075 \times 2.013 \times 1.6 = 29{,}229$
$11{,}925 \times 2.013 \times 2.7 = 64{,}814$

Ton miles.....94,043

MIXING PLANT, WEIGHT AND OPERATING COST

Estimate: 2 ½ cu. yd. mixers, complete with batch transfer, 20,000 lb. each; 2 finishing machines, 2,600 lb. each; and 1,500-ft. steel side forms weighing together 7,500 lb. Total weight, 52,700 lb.

For overhead figure: 25% depreciation; 6% interest; and 5% repairs.

For daily operating cost figure: 4 batch transfer men, 2 train men, 2 mixer operators, 2 firemen, 4 side form men, 4 concrete spreaders, 4 dirt spreaders, 2 foremen, and coal and oil.

Total cost of operation:

78 days × $..... Daily payroll ..... = $.....
Freight and overhead..... .....

Total .....$.....

For cost per sq. yd. divide operating cost by total sq. yd.

UNLOADING PLANT, WEIGHT AND OPERATING COST

Tunnels will be considered in this estimate instead of bins, and a flow capacity for 2 days will be provided. The tunnels must, therefore, be for sand 80 ft. long, for stone 150 ft. long and the cement shed 70 ft. long. A 1 cu. yd. full circle swing crane is necessary to handle 400 cu. yd. of materials per day.

For cost of plant estimate: 230-ft. tunnel; cement house with 10 wood hoppers; 4 doz. tunnel traps weighing 1,080 lb. each; 1 unloading crane weighing 50,000 lb., and 1 1-cu. yd. clamshell handler, weighing 3,200 lb. Total weight, 57,520 lb.

For cost of operation figure: Tunnel installation (twice); cement house installation (twice); and 1 crane operator, 1 fireman, 2 clean-up and bucket men, and 1 foreman for 78 days; and unloading and handling 36,120 bbl. of cement. Cost of siding lengthening not included.

To this add: Unloading freight as above; 33⅓% depreciation on tunnels; 50% depreciation on cement house; 16⅔% depreciation on tunnel traps, crane and clamshell; 6% interest and 5% repairs.

Material handled:

Sand .....21,000 × .46 = 9,660 cu. yd.
Stone .....21,000 × .8 = 16,800 cu. yd.

Total .....26,460 cu. yd.
Cost per cu. yd. for sand and stone of ..... ct.

WATER PLANT, WEIGHT AND OPERATING COST

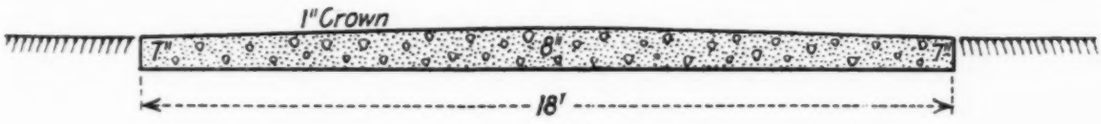
Estimate: 2 pumping plants on 4-wheel wagon trucks, 4,000 lb. each; 10,000 ft. of 2-in. pipe; 100 1 by 2 in. tees; 8 cut-off valves and 4 20-lb. pressure valves weighing 35,000 lb. Total weight 43,000 lb.

For cost of operation figure: Laying and taking up 60,000 ft. of pipe; 2 pump operators and 2 pipe men for 78 days; gas and oil, 10 50-ft. hose sections, 33⅓% interest, depreciation and repairs; and freight.

SUMMARY OF COST

For a summary of labor cost figure hauling materials, unloading materials, mixing and placing, water plant; and total. This job figured $56,700.

The total estimated cost of plant alone was $81,700.



SHOVEL OPERATING KINKS

THE output of a steam shovel depends mainly on the energy, skill and brains put into the work by the operator. This means taking good care of machinery and operating it with judgment.

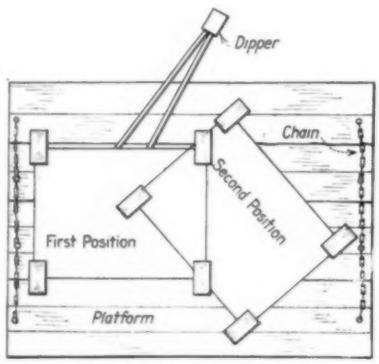
A loose bolt or improperly adjusted gear or bearing will produce a knock which is the forerunner of a knock-out. Make temporary repairs yourself so that the shovel will continue to operate until such times as permanent repairs can be made.

Use a compact track section for shovels equipped with railroad wheels as shown in the figure. The rails are held in place by clips and coupling pins, the clips being slotted slightly to facilitate coupling. Eye bolts at the end of the ties enable the shovel to handle the track and lay it down ahead.

Wooden platforms used for shovels equipped with broad wheels may be made as shown in the figure. These sections are moved by the dipper arm with the aid of a sling chain. An expert operator will lift, swing and drop the track sections in a correct position. Make the platform sections of hard, tough lumber.

Have the pitman place the track or platform according to material below. This prevents trouble and reduces wear and tear.

Turn the shovel by traction device or skidding. Skidding can of course be done only on a platform. To skid the shovel the platform sections under the shovel are chained together and the near rear wheel is chocked to prevent forward movement. The dipper is thrust vertically downward to a firm bearing, and on being subjected to a slight pressure raises the boom, taking the load off the front wheels. Manipulation of the swinging and traction levers forward gives thrusting force which produces a lateral slipping of the front wheel and a combined lateral and forward movement of the wheels on the opposite side of the shovel. The nearest rear wheel turns on a pivot or moves backward slightly. If the platform is slippery the shovel may be skidded by simply setting the boom and operating the swinging engine without chocking the wheel. Skidding may also be done on a dirt foundation by feeding 4-ft. plank under the wheels.

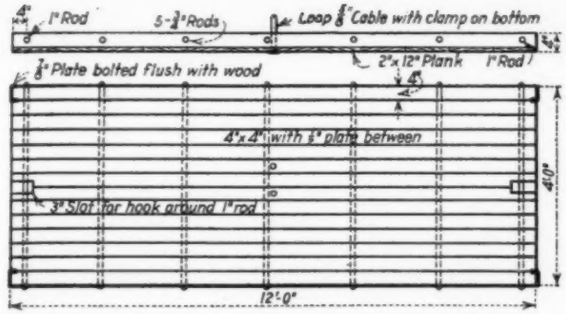


SKIDDING A SHOVEL

Skidding makes it possible to turn the wheels of the shovel completely around in the minimum time and to proceed in a new direction. In foundation excavation this enables the shovel to turn at right angles or completely around in not more than 3 min. But the movement must be effected with good judgment and care to prevent injury to the shovel.

A full dipper load with the least possible effort in the shortest time is the primary object of the operator. The kind of material dug is an important factor. For example, if the material is a shale-like clay it requires slow thrusting and lifting movements in order to give enough time for fracturing the material. A tough but soft clay may be peeled off in thin slices. Rock excavation calls for poising big fragments on the dipper teeth and picking up the smaller fragments together. The operator must use foresight in loading each dipperful in a manner that will prepare the way for getting a succeeding dipperful.

When the boom swings low the "reach" is increased and the "clear lift" is decreased. Adjust the boom so that the shovel weight and the dipper load will balance when swinging. This reduces wear on the machine. Lengthen-

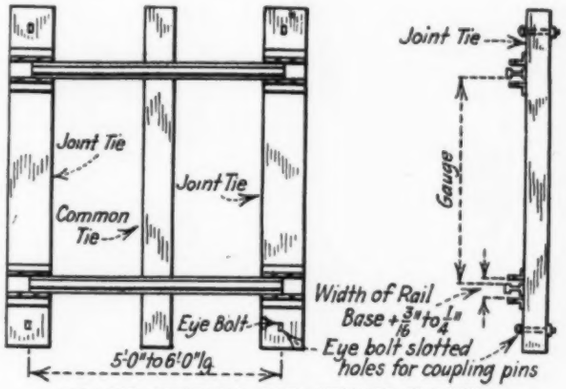


SECTION OF A SHOVEL PLATFORM

ing the boom supports increases the operating wear. Make the complete operation of digging, swinging and unloading one continuous movement. Coast the dipper to relieve the boom and engine for a short distance at the end of the delivery swing. This frees the engine cylinders from steam and leaves them in readiness for the reverse movement which returns the dipper for reloading.

Carelessly effected delivery injures cars and wagons, especially in rock excavation. Common sources of loss of time in handling the shovel are: (1) failure to place the dipper in the proper position for digging; (2) not stopping the upward movement of the dipper immediately after it is filled; (3) lack of skill in adjusting the elevation and distance of the dipper while swinging so that it will be in readiness for delivery; and (4) failure to release the dipper door immediately when in position for unloading.

In excavating for building foundations the earth may be transported as illustrated on the opposite page and loaded directly into wagons on the banks. The teams or wagons need not enter the pit.

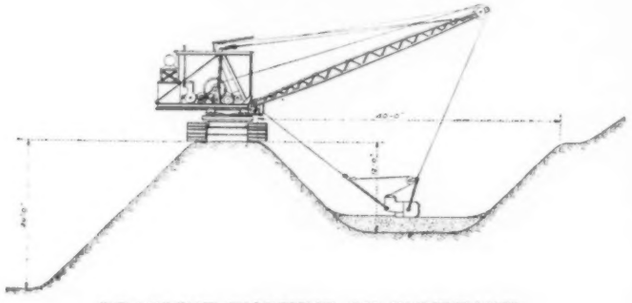


TRACK SECTION FOR STEAM SHOVELS

DRAGLINE GYMNASTICS

Irrigation Ditches Cleaned From Spoil Bank

MANY of the irrigation ditches built under the supervision of the United States Reclamation Service are cut from the side-hill, the spoil from the ditch forming the bank on the downhill side. In order to clean the



DRAGLINE WORKING ON SPOILBANK

bottom of these ditches of an accumulation of material approximately 2 ft. deep it was necessary to have a machine that would operate on the narrow top of the ditch bank. This was accomplished by the use of a machine with a continuous tread, as shown in the figure.

Frequently the top of the bank was so narrow that but one-half the width of the tread was available to support the machine. In places it was necessary to widen the top of the bank so that the machine could advance. This operation was performed by the machine as it proceeded. Where it was necessary to build roads the work was readily done, the machine following over the road it had just completed. Equipped with a 30-foot boom, the bucket was thrown 20 ft. beyond the end of the boom and 45 cu. yd. of material an hour handled from the trench.

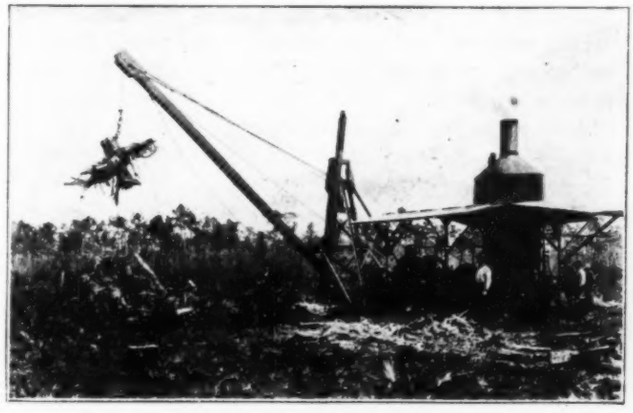
WHOLESALE LAND CLEARING

How Land Is Cleared by Machinery in Florida

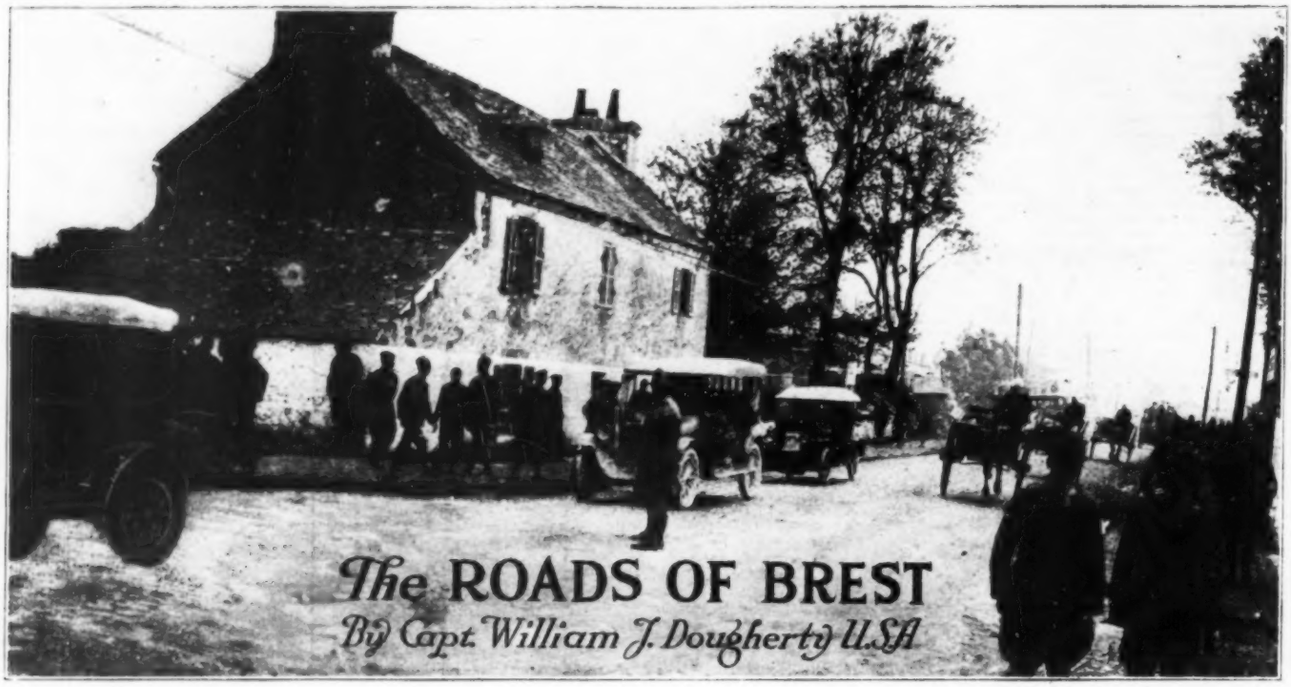
A MACHINE that is attracting hundreds of visitors to the site of its work is the giant stump-puller in use by the Reolds Farms on a 37,500 acre land clearing project near Oldsmar, Fla. The machine weighs 90,000 lb. and has a pulling power of three 100-ton locomotives.

The machine is operated by 14 men and pulls the stumps and living trees from 2 to 3 acres of land every 9 hours. A main cable 150 ft. long and 2 in. in diameter is used to fasten around the stumps and to pull out the main cable after it has drawn a stump up to the machine. A boom with heavy steel tongs attached to cables is used to lift the stumps and drop them on the ground to jar the soil loose and then pile the stumps ready for burning.

In moving forward, the main cable is attached to an extra big tree or stump, the engine is started, and the cable slowly wound on the drum, dragging the machine forward on skids which are part of the machine.



PILING UP THE STUMPS



The ROADS OF BREST

By Capt. William J. Dougherty U.S.A.

During the period covered by this article Capt. Dougherty, who was attached to the 28th Engineers, was in charge of road construction at Camp Pontanezen near Brest.

LIFTING Brest out of the mud was the task which confronted the U. S. Army engineers when the war ended and the American troops swarmed into the French seaport on the first lap of their homeward journey. Strictly speaking, the words Camp Pontanezen should be substituted for Brest in the foregoing sentence for the work to be described was done in and about the Camp which is about 3 miles northeast of the city.

It was a veritable network of roads that the army engineers built, radiating in every direction from the old stone barracks once used to quarter Napoleonic troops. In the beginning an attempt was made to preserve the integrity of the small individual plots of land, each surrounded by grass covered walls of earth, and dating back to the days of the Feudal system. As the work went on it became evident that this over scrupulous regard for individual rights was hardly practical, and the later roads were put where they were needed most.

The broken stone road proved to be the only type that could be considered. In the first stage of the construction the best had to be done with whatever local materials were available, and certain refinements of construction and technique in road building had to give way to pressure and speed. Mileage of road that would carry the heavy traffic was the first requirement.

Stone was crushed, hauled and spread at night as well as in the day and this was made possible by the use of acetylene flare lights. "One man" stone for stone base and Telford construction has been used extensively in the sub-base construction especially on the main traveled roads and approaches to the warehouses. When this was not available it was necessary to increase greatly the thickness of broken stone to get supporting power on the treacherous soil.

The main road through camp is one of the principal routes of the French highway system and was in excellent shape previous to the coming of heavy American army trucks carrying troops, baggage, subsistence, and materials of all descriptions between the camp and the Port du Commerce at Brest. From the standpoint of traffic census the following list of vehicles passing at a representative point, in 24 hours, is of interest.

Description of Vehicles passing in 24 hrs.	Friday, Dec. 27	Monday, Dec. 30	
3 & 5 ton trucks, light	350	393	35 per hr. or 1 truck every 1 min. and 42 sec.
3 & 5 ton trucks, heavy (loaded)	489	457	
Trucks with trailers	23	...	one car every 13 min.
Tourings cars	115	88	
Runabouts	6	7	
Motorcycles	18	6	one wagon every 7 min.
2-horse wagons	48	29	
Single peasant farm wagons	166	139	

Needless to say under this heavy traffic moving at a rapid pace, and under the inclement weather this road failed utterly and at early periods in the work was next to impassable. Of course the road had never before been subjected to such heavy traffic, nor like all other French roads of the older class was it ever meant to be, and since the road metal was comparatively shallow, it is not surprising that it gave way entirely.

In the first stage of the road construction in Camp Pontanezen, the stone was furnished locally from four quarries, two at Brest and two within the camp limits. The greater portion of the road stone came from the Brest quarries. The rock encountered at Pontanezen was of igneous origin—weathered granite for the most part and not wholly desirable for road building purposes. However, this was used in conjunction with the Brest product which was better road stone. Compressed air was used exclusively in the operation of the rock drilling machines. Gelatin dynamite was used for blasting purposes, being detonated by electric blasting caps or straight blasting caps and slow ("time") fuses. Owing to the close proximity of billeting areas it was not possible to make heavy and shattering blasts, so considerable "block holing" had to be done. The crushing of stone for road material was

accomplished by small crushers of the portable type. In this case, as in most others in the A. E. F., portability of crushing equipment was the seemingly predominant feature in the selection of plants.

Later on when it was proved that the local stone material was not hard or tough enough to stand the abrasive action of traffic the expedient of importing harder stone was tried. Hard, tough stone was brought from Rennes, France, about 200 kilometeres from Brest, and was used to resurface the main arteries of the Camp.

Rolling of road stone was accomplished by the use of several French steam rollers and two American gasoline driven road rollers of about 12 tons weight. Much can be said for the success of these American rollers as they proved entirely satisfactory for this class of work.

In connection with the road construction on the main Brest road, much difficulty was experienced with the edges of the roadway, as, under the traffic which used every available square foot of roadway, the tendeucy was to sluff away to the rather deep side ditches. The construction of strips of granite block paving, 4 ft. wide with sand bed cushion, along the edges of the road served to eliminate this trouble. Granite block also was used on several road intersections and in front of Army Headquarters. Generally speaking the blocks are of heavier nature than those usually handled in the States and the paving was done almost wholly by French civilians on the basis of a price per square meter laid.

At the present writing May 25, 1919, the road improvement at Pontanezen has for the most part resolved itself into a maintenance and repair matter, and this is no small job as under the continual heavy traffic considerable repairs have to be made. Some resurfacing is in progress at the present time. The French "caminero" system of maintenance and repair, in which an individual has so many lineal meters assigned to his care, has been used with much success in other parts of the Base Section where French civilians were available for this work, but at Camp Pontanezen the method of working the soldiers in small detachments or groups proved more satisfactory.

In the early stages of camp construction, at a time when great pressure was being brought on the engineering and construction force at Camp for rapid progress in the work, the motor trucks hauling subsistence, equipment, and construction materials of all kinds were being operated at all practicable speed. Naturally, with the assistance of the wet weather, the damage wrought by the trucks on the roads was great. Several months ago an order of the Commanding General of the Base regulated the speed of the trucks to 6 miles per hour and 10 miles per hour for light transportation. The results proved conclusively that nothing better could have been accomplished in the way of minimizing repairs and upkeep.

Quite the most remarkable feature of the road construction of Camp Pontanezen has been the continuous operation of all phases of the work night and day until such condition was reached which warranted day operation only. Quarries were operated for 24 hours of the day, as well as truck hauling of stone, unloading, placing road rolling, and at the present writing, sprinkling. In certain cases this has been made possible by acetylene flare lights and in others by clusters of small electric lights.

The main traveled roads in camp which were improved—built new, resurfaced, extensively repaired, etc.—aggregated a lineal distance of approximately 9.85 miles of varying widths of roadway or the equivalent of 6.01 miles of metalled roadway 16 ft. wide. As has been previously stated, owing to inability to select wide locations for the roads, some were of necessity quite narrow and required much upkeep and repair. Less traveled and more isolated roads, as well as large areas in close proximity to warehouses, hospitals, motor parks, and garages, corrals, wagon parks, etc., were improved with broken stone surface to the extent of the equivalent of approximately 6.05 miles of 16 ft. roadway. A total of 4,614 sq. yd. of granite block paving was laid in all or the equivalent of .49 miles of 16 ft. roadway. No mention is made in this article of "corduroy" or tie road construction which was done under another department head, which totalled a distance of approximately two miles. This construction was accomplished at the very muddiest period and proved an efficient emergency measure.

With good weather and the transportation of construction material a thing of the past, it will not be difficult to keep the roads in good condition and they will be turned over to the French authorities in as good, if not better condition, than when the Americans came to Brest.

A TALK WITH WALTER A. ROGERS

Engineer—Contractor—Organizer of Men

"MR. ROGERS, the Bates & Rogers Construction Co., has the reputation of being an unusually compact organization. How did you make it so?"

"I didn't do it," answered Mr. Rogers. "We all work together. Most of our men have been in the organization a long time. We know what to expect of them and they do it. We don't lay stress on organization, charts or diagrams. When something pressing is to be done we select the right man to do it and we all jump in and help him clean it up."

"But, Mr. Rogers, I think the organization you use in handling your work ought to be very interesting to other men engaged in similar business. How do you go about getting work accomplished?"

"Our superintendents are virtually separate contractors," explained Mr. Rogers. "Most of them have grown up in our business and are familiar with our methods and jealous of our good name and ideals. Each one has complete charge of his job, handles all the details and is responsible for its success. With a little team work the job is put over efficiently and economically."

WALTER A. ROGERS

In 1901 Onward Bates and Walter A. Rogers, both successful railway civil engineers, started the present organization. Their first job was a contract for concrete work on a new line of the Wabash Railroad. The work was a success and from that time on the firm grew. In 1907 Mr. Bates was elected president of the American Society of Civil Engineers and withdrew from the firm. Since then Mr. Rogers has been president of the organization. The other officers of the organization are: E. P. Lenahan, vice-president, with headquarters in Spokane, who has charge of the western work; E. Stanley Holland, vice-president, who has headquarters in Chicago; and C. V. Burghart, who is secretary and treasurer.

At the beginig of the war the firm was one of the 16 contractors selected to build army cantonments. It had the general contract for the building of Camp Grant. After the completion of Camp Grant Bates & Rogers built the railroad yards, earth dikes and timber cribs in the Hog Island shipyard; also a considerable part of the Interior Storage Depot near Harrisburg. At the time of the signing of the armistice they were building wooden ships in Florida and Nitrate Plant No. 3, estimated to cost $20,000,000, for the War Department. During the war the aim of the company was to devote the organization entirely to war work.

"How did you get superintendents for these big emergency jobs?" asked the editor.

"Our regular men formed the nucleus. For the balance we took men wherever we could find them. Practically all of our superintendents, however, entered our employment in some subordinate capacity and have risen to their present places by application and hard work. They become imbued with the spirit of the organization and are promoted according to their capabilities."

"How do you pick good men?" the editor queried.

"We just watch them and give them an opportunity to develop along the lines to which they seem best adapted. We give them responsibility as rapidly as they can take it. Our superintendents are trained to handle any type of work, whether it is road work, railroad work or any other kind of work in the construction line."

"In preparing bids for work," continued Mr. Rogers, "one or more superintendents investigate the work on the ground. Then a consultation is held and the figures subjected to critical analysis. If the work is awarded to us, a superintendent is assigned to the contract and in consultation with the main office the method of handling the job is worked out in detail to correspond with the general plans on which we have based our bids. Then the plant required is determined upon and the assembling of plant is started. The superintendent with a nucleus of his force gets on the job and begins to build up an organization. After the work is in progress he assumes full responsibility.

"It is possible on going on a job to feel that everything is going along swimmingly or that the work is disorganized, just as one riding in an automobile can tell whether every cylinder is working or whether one or more cylinders is missing.

"A good superintendent has continually in mind two things: first, in order that the contractor may stay in business he must do a first-class job, complete it on time, and make friends with the clients by doing so; second, he must do his work at a profit or it is not a success.

"The things that go to make a successful superintendent are largely the same as those which make a successful contractor. These qualifications are both business and moral. He must be a good executive, able to judge men, and able to place his forces so that each man is in the position for which he is best adapted.

"In many emergencies he must know what to do 'right off the bat.' I often think that his training should fit him to be a diplomat. The faculty of being able to get along well with people is one that has definite money value. It costs money to be at variance continually with those for whom one is working. The ability to look at things from the other fellow's standpoint as well as your own is a good habit to form. The other fellow in a majority of cases intends to treat you right. What should be done is to get him to see things from your point of view.

"A good address is a valuable asset, and the longer I live, the more I am impressed with the importance of being able to talk convincingly on your feet, an accomplishment which I have never acquired," he added, laughingly.

"The habit of observation should be cultivated. Loyalty to the employer is, of course, essential. But the two most important qualifications without which I believe it is impossible to become successful are: first, willingness to assume responsibility. It is better to do something and do the wrong thing than not to do anything. The other qualification is what I call 'stick-to-it-tiveness.' What is wanted is men who do things they start out to do in spite of good reasons why they cannot be done; who do not know when they are beaten; who do not know how to quit."

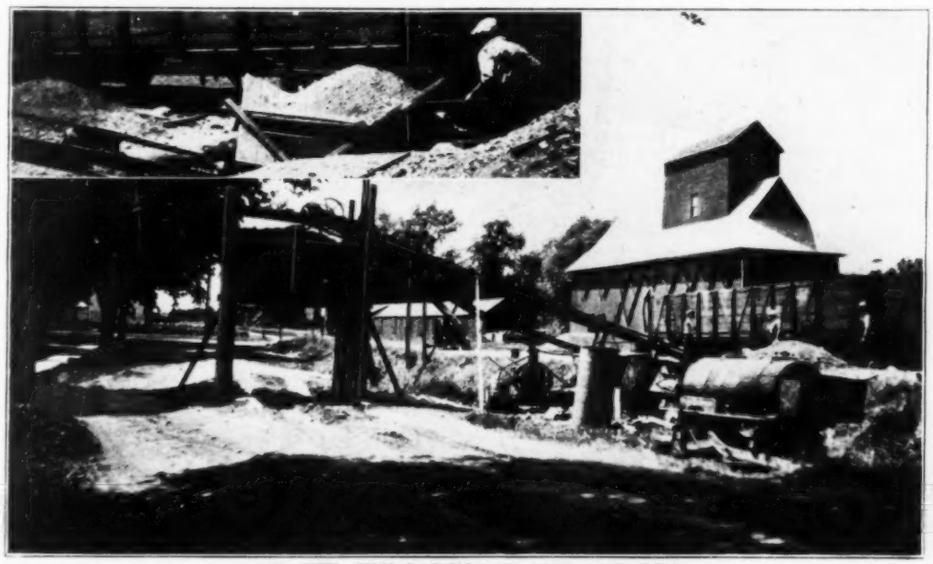
Mr. Rogers sums up the success of his company—"Our organization is responsible for it"—but he is responsible for the organization.

UNLOADING RAILROAD CARS

Belt Conveyor Used for Gravel

THE belt conveyor unloader illustrated is used by A. Guthrie & Co. of St. Paul, Minn., for unloading material for a 22-mile road job near Wabasha, Minn. This conveyor is 50 ft. between centers, has an 18-ft. lift and an 18-in. belt. Power is furnished by a 6 hp. gasoline engine. The hopper bin has a capacity of 18 cu. yd.

Material is taken from a pit where it is dumped from side dump cars. The cars are moved to position with bars in most cases, but a 9 hp. gasoline hoist and a block and tackle are provided for use when necessary. The hoist and tackle are used to haul the empties out of the way.



GRAVEL UNLOADING PLANT AND BIN

The plant has a capacity of about 200 cu. yd. in a 10-hr. day, and is operated by two men. Two 5-ton motor trucks operating 15 hr. a day made 7 trips on an 8.1 mile haul.

This method of unloading material from hopper bottom railroad cars has many advantages. The number of men required for operation is reduced to a minimum and the problem of loading material into trucks or industrial cars is simplified. The whole plant can be erected or moved to another location in a short time, a fact which adds greatly to its value. When one job is done and there is another waiting it is easy to effect the transfer without appreciable loss of time.

EFFICIENCY IN NIGHT WORK

Owl Shift vs. Eagle Shift

IT is generally agreed that night work is not as economical as day work where the work is done out of doors; but a thorough investigation of the reasons for the difference seems never to have been made. Consequently most contractors fight shy of night work, relying entirely upon the supposed truth of the generalization that it never pays except where work must be rushed to a finish.

Halbert P. Gillette in *Engineering and Contracting* says his own experience leads him to believe that there need be little difference between the output of the "owl shift" and the "eagle shift," provided two or three matters receiving prompt attention. The first of these is the matter of lighting. The second is the matter of warmth and food. The third is supervision and cost keeping.

Poor lighting retards progress because men can not work effectively in a twilight, and because it depresses the spirits of workers. The mere fact that it is night has in itself no ill effect on the output of workmen. The night shift in a mine is quite as efficient as the day shift.

Night work above ground is often cold work in the spring and autumn. It therefore pays to see that the men are well clothed and that bonfires or other means of warming up are provided. Frequent feeding is another important item.

CHART FOR CURVE WIDENING

How to Lay Out a Lune—Chart Method Recommended

By Edward H. Steele
Assistant Construction Engineer, Minnesota Highway Department

THE method of laying out additional widths on curves, which has just been put in use by the Minnesota State Highway Department, is, so far as I know, entirely new and may be help to others engaged in similar work.

The layout of a sample curve is shown in the figure. To make the problem definite, it is assumed that the intersection angle is 21° 50′, and the center line curve has been designed as a 14° curve.

In the lower right-hand corner of the chart is a graph showing the required additional width for various degres of curvature. A 14° curve requires 3.8 ft. additional width. It may be taken as 4 ft. (the nearest even foot) for ease in computation. The degree of curvature which will give the required extra width is secured from the graphs of external distances for various degrees of curve. Find the intersection of the 14° curve line with the 21° 50′ (21.88°) ordinate. From this point measure vertically upward 4 ft. and read off the nearest degree of curve, which is 10°. This is the required curve.

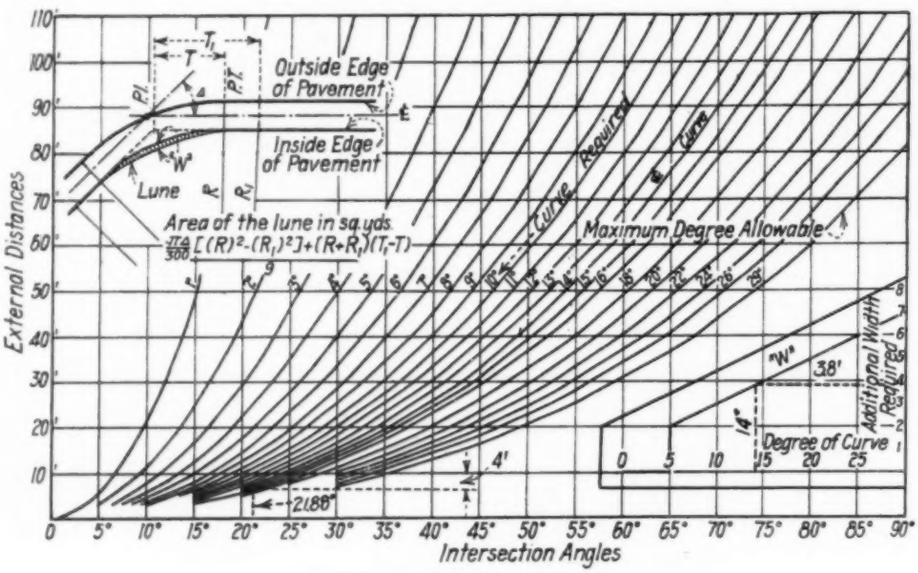


CHART FOR CURVE WIDENING

In computing the area of this additional width, use the formula given. The precision of the tangent distances is the controlling factor in the formula used, and computation should be carried to three decimal places.

PROSPECTING FOR GRAVEL

One or two test holes are not enough to locate a gravel pit according to Halbert P. Gillette in *Engineering and Contracting*. Holes should be drilled not more than 200 ft. apart, and 150 ft. apart is preferable. It is better to spend $500 or $1,000 in a preliminary survey than it is to erect a $10,000 plant, perhaps, and then find that the gravel deposit is so light or so scattered that the plant cannot be operated profitably.

The common practice is to employ well drillers to drill the test holes. Six-inch casings are sunk 30 or 40 ft. deep, using an A-frame and improvised driver, or in some cases a blast-hole drilling machine.

An Indiana contractor, in testing for smaller gravel deposits where he has a contract to throw out from 5,000 to 20,000 yd., has devised a simple but satisfactory testing method. One end of a short length of ⅝-in. rod is finished with a chisel edge or barbed point. The rod threads into a 1-in. pipe which is driven into the ground about 10 ft., accompanied by continual turning of the chisel-edged pipe. It is simply a matter of the contractor trusting to his hearing to determine the presence of gravel, and the scheme is entirely satisfactory for testing a small deposit.

CLEANING DRAINAGE CANALS

Logs, trees, tree-tops, stumps and drift were taken out of a channel, young sprouts from stumps on the bank, and willows and cottonwoods which spring up in and along the channel were removed in the Bogue Phalia Drainage District in Louisiana in the following manner:

Small contracts were let to negroes living close to the canal, who cleared small stretches near their cabins. Crews consisting of a foreman and 10 to 20 negro laborers were organized. These parties lived in tents near the work, moving camp whenever necessary.

In clearing a ditch, some of the men removed the small drift and pulled willows and sprouts that one man could pull; the remainder of the crew followed behind and cut the sprouts that were too large to be pulled. The men kept near enough together to assist one another in removing drift too large for one man to handle. Trees in the channel usually had to be sawed into pieces before they could be removed. Willows and small drift were thrown on the spoil bank. On large channels, where the distance to the spoil bank was too great for throwing, the debris was either piled and burned, or carried out of the ditch.

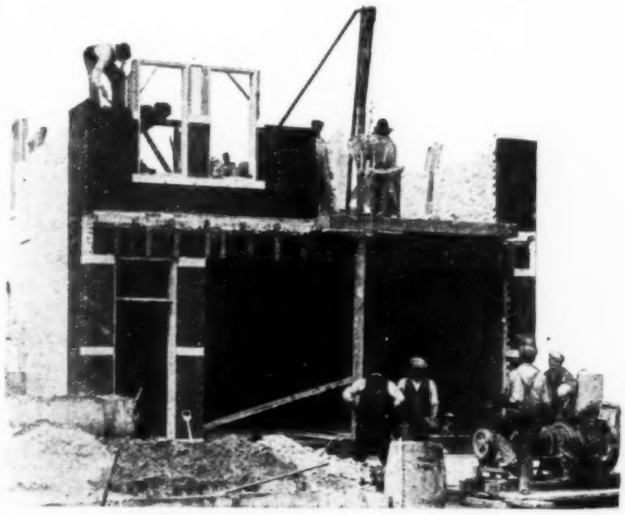
Machetes, brush axes and grubbing hoes were used for cutting the growth too large to pull. The machete proved the most useful tool for this kind of work. A cross-cut saw, sledge, wedges and axes were used for cutting up trees and large debris. Cant hooks were used in handling the heavier logs. Cotton or canvas gloves prevented sore hands among the laborers pulling sprouts.

The proper time to remove growth is while the sap is up (May to Sept. in Mississippi), for if the sprouts are pulled or cut when the sap is down, the pieces of roots broken or cut off below the surface shoot up much more readily the following season.

HOISTING WHEELBARROWS

How Small Building Construction Can Be Speeded Up By Judicious Use of Small Plant

MOVING plant on and off the job is often quite an item of expense in the construction of small buildings. The size of the contract involved in the construction of most small 2-story buildings is such that a large amount of plant is hardly justifiable.



SMALL HOIST TURNS THE TRICK

The equipment illustrated was used to advantage by Steve Czaplewski in the construction of a small 2-story building in Milwaukee. The hoist illustrated is of the gasoline type, and by a simple arrangement of pulleys and a swing derrick arm, a quick and satisfactory method of hoisting material was worked out. The wheelbarrow is slung with a chain and upon arrival at the second story, the derrick arm is swung around and the wheelbarrow deposited on the floor. The same arrangement is used for handling lumber and other heavy materials.

AVERAGE LOADS FOR TEAMS

The following observations on hauling by horses on an ordinary country highway, approximately 38 miles in length, were made during the construction of a storage dam at Aziscohos, Me.:

	Sleds, Dec. 5-Jan. 15, Lb.	Summer, Lb.	Adverse conditions Lb.
4-horse team	6,650	5,750	4,800
5-horse team	8,600	....	6,200
6-horse team	10,400	8,400	7,200
Average load per horse	1,680	1,130	1,220

SELECTING AND PROTECTING ROPE

A good hemp rope according to John Upton in the *National Builder* is hard yet pliant, of a yellow or greenish gray color, and has a sort of silver or pearly lustre. A dark or blackish color indicates that in the process of curing the hemp has suffered from fermentation. Brown spots tell us that the fibers were wet when spun, and are weak. Sometimes good hemp is used for the outside and a poor quality for the inside. This can be detected by making an examination of the end of the rope. Ropes which have a woolly appearance, or where the ends of the fiber protrude, should not be used for important work.

All ropes should be protected from dampness. They can be soaked in a solution of bluestone (copper sulphate). Have your rope dry. Let it lie in the bath for three or four days and then dry thoroughly. Ropes are frequently allowed to unravel at the ends and thus become shorter. If a crown were woven at the end, or even a piece of twine wrapped around it, this might easily be avoided.

LABOR SAVING MACHINERY BUILDS LEVEES

Levee construction involving 23,413,268 cu. yds. of earth work was carried out in Louisiana during 1917-18. Of this work 70% was accomplished by power driven machinery, 24% by mules and scrapers and 6% by men with wheelbarrows. The unit costs by these methods, according to the annual report of the Board of State Engineers, were as follows: Power driven machinery $0.1514 per cu. yd., mules and scrapers, $0.2204 per cu. yd., men with wheelbarrows, $0.2291 per cu. yd.

The work included the building of 65.17 miles of new levee and the enlargement of 232.42 miles of old levee.

PLAY IN ANCHOR BOLTS

In setting anchor bolts in the foundation piers for the new viaduct built in connection with the widening of Michigan Ave. in Chicago, the Great Lakes Dredge and Dock Co., contractors, used the method illustrated to provide play in the bolts.

A section of old stove pipe 6 in. in diameter and about 8 in. long was placed over each bolt as the concrete was poured. This provided 3 in. play in any direction for each anchor bolt. After the bolts are bent to fit the holes in the steel bearing plate which goes on top of the piers, concrete is placed around the bolts filling the holes made by the pipe, and the bearing plates placed in position.

OLD STOVEPIPE SET IN CONCRETE FACILITATES ADJUSTMENT OF ANCHOR BOLTS

DOUBLE WORK FOR WAGONS

Extra Body Increases Capacity to Two Batches on Each Trip

ONE wagon does the work of two for the Griff Construction Co. on a job at Moreheadville, Pa., thanks to an extra body which is fastened to the top of the wagon. The method of construction is clearly shown in the illustration.

The wagon is an ordinary bottom dump wagon with an end dump body fastened on top. This makes it possible to load each body with sand and stone in proper proportions to make a one, two, three mix for a 1-yd. mixer, transport them from the loading plant to the mixer and dump both loads almost simultaneously, the load from the extra body falling directly into the skip while that from the wagon proper drops on a steel plate, from which it can be shoveled directly into the skip when its turn comes.

A TWO-IN-ONE WAGON

SIMULTANEOUS DUMPING

The use of this device does away with stock piles on the subgrade, and two batches are hauled from the loading plant to the mixer in a single trip. By employing these wagons the Griff Company is finishing about 300 ft. of road per 12-hr. day. On a 1½ mile haul, 17 teams kept a 1-yd. mixer going at top speed.

SHOVELING THE SECOND BATCH IN THE SKIP

WEAR ON HAND SHOVELS

By G. Townsend Harley
Efficiency Engineer, Phelps Dodge Corporation, Tyrone, N. M.

TO determine the relative wear and cost per ton of shovels a study was made at one of the largest copper mines in the Southwest, the results of which were first published in the Transactions of the American Institute of Mining Engineers.

At different places in the mine men were equipped with different makes and styles of shovels and at frequent intervals measurements were made to detect the wear on the blade, the tonnage coming from each gang of shovelers and the number of shovels employed by each gang.

Results based on these observations were as follows:

Type of shovel	Used on	Tonnage handled by blades of Chrome-nickel steel	Secret composition steel	Common carbon steel	Extra light carbon steel
No. 2 scoop	Iron sheet..	1,220	950	750	....
No. 2 scoop	Wooden mat	1,500	1,100	900	....
No. 4 shovel	Iron sheet..	990	770	620	250
No. 4 shovel	Rough bot..	1,075	870		
No. 4 shovel	Wooden mat	1,168	1,000	730	340
Gauge of steel in blade..		15	13	11	
Cost of shovel per ton... handled, ct.		0.0015	0.0018	0.0019	16 0.0026

The shovels made of chrome nickel and special steel were excellent implements but the special steel shovel was considerably heavier than the other. Cracks developed along the form line of the chrome-nickel steel blade on each side, but these did not impair the shovel's usefulness. The blades of the 3 other shovels bent easily with rough usage; while the blade made of extra light carbon steel wore rapidly and the edges curled up almost immediately.

The No. 2 scoop was used until its capacity had been reduced 25% and the No. 4 shovel, until its capacity had been reduced 9%. The cost of shovel per ton handled includes the cost of the shovel, freight, supply-house handling, handling new shovels into mine, and disposal of worn shovels. We had hoped to be able to detect a difference in the man efficiency on account of the different styles and weights of shovels in use at this time, but, owing to the constantly changing conditions in the working places selected for the trials, no conclusive evidence was available.

The wearing quality of any shovel used on an iron sheet varies from 74% to 86% of the wearing quality of the same shovel on a wooden mat, the average being 82%. The wearing quality of a shovel on a rough bottom is about 90% of that on a wood mat. These figures are based on about 50 shovels observed underground.

These tests are among the first made to determine accurately the value of different types of steel in prolonging the life of shovels.

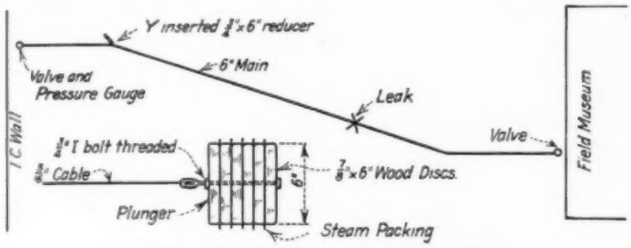
FINDING A PIPE LEAK

How the Position of a Leak in a Waterpipe Buried 30 Ft. Was Located

A LEAK in a 6 in. water main buried under a 30-ft. fill in front of the Field Museum in Chicago was located by the following method:

The water was cut off at the valve near the Illinois Central right of way retaining wall shown in the figure. The pipe was cut and a Y laid on its back was inserted, through which the diaphragm plunger shown in the figure was passed. This plunger was made of six 1-in. discs with rubber steam packing between and a threaded eye bolt run through the center to which a 5-16-in. wire cable was attached. The end of this cable was first threaded through a ¾ by 6 in. reducing bushing with the ¾-in. opening packed to make a water tight joint around the cable, after which the reducer was placed in the open end of the Y. A pressure gauge was put in at the valve near the Illinois Central wall.

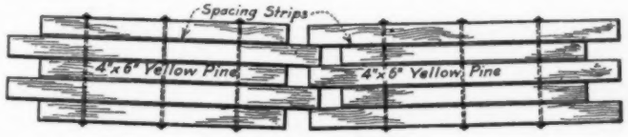
Water was turned on, the valve at the building closed, and about 6-lb. pressure obtained in the pipe by opening slightly the valve at the Illinois Central wall. The plunger moved along the inside of the main until the leak was reached, when the pressure disappeared and the plunger stopped moving. This located the leak, the distance from the Y being determined simply by measuring the cable as it was paid out. The plunger stuck once or twice, necessitating an increase of the pressure to 18 lb. until it started again.



HOW THE LEAK WAS LOCATED

The method was devised by Howard White of Graham, Anderson, Probst & White, architects of Chicago, and was executed by R. J. Powers, the plumbing contractor.

TIMBER TRACKS FOR LIGHT STEAM SHOVELS



Timber track sections have been used with success as runways for light steam shovels. The sections are made of 4 by 6-in. timbers with thin spacing strips between and are bolted together by three ½-in bolts. The sections are 4½ ft. long, but this length would vary with the machine. The runways are particularly serviceable in making turns, as there is enough play in the interlocking joints to permit the taking up of a section and moving it over one notch, thus allowing the rear wheel to run squarely on it.

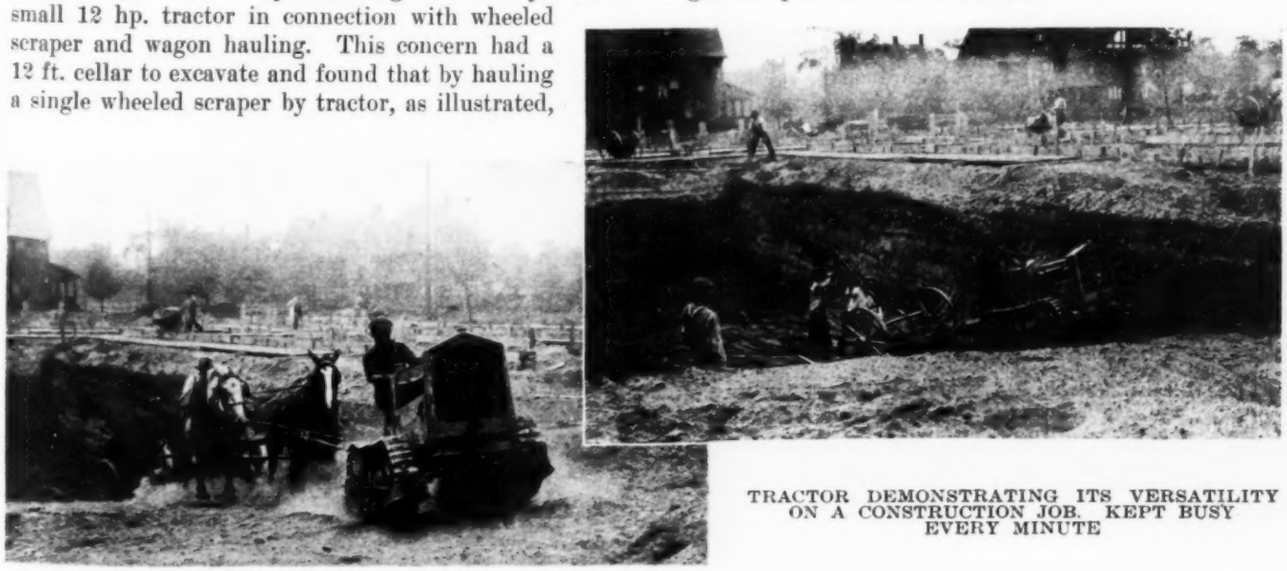
POWER WHEELERS

Handling Earth With Power Scraper

MANY contractors have felt for some time that mechanical methods must replace horses and mules. This necessity has been brought about by the high price of feed and the cost of labor.

The William Dunbar Co. of 8201 Cedar Ave., Cleveland, Ohio, has been experimenting successfully with a small 12 hp. tractor in connection with wheeled scraper and wagon hauling. This concern had a 12 ft. cellar to excavate and found that by hauling a single wheeled scraper by tractor, as illustrated, as much dirt could be removed as with 3 team-drawn wheeled scrapers and a deeper cut would be made.

Part of the excavated material was taken out by team-drawn dump wagons, and a tractor was used in place of snap teams for helping the load out of the pit. A gallon of gasoline per hour was consumed.



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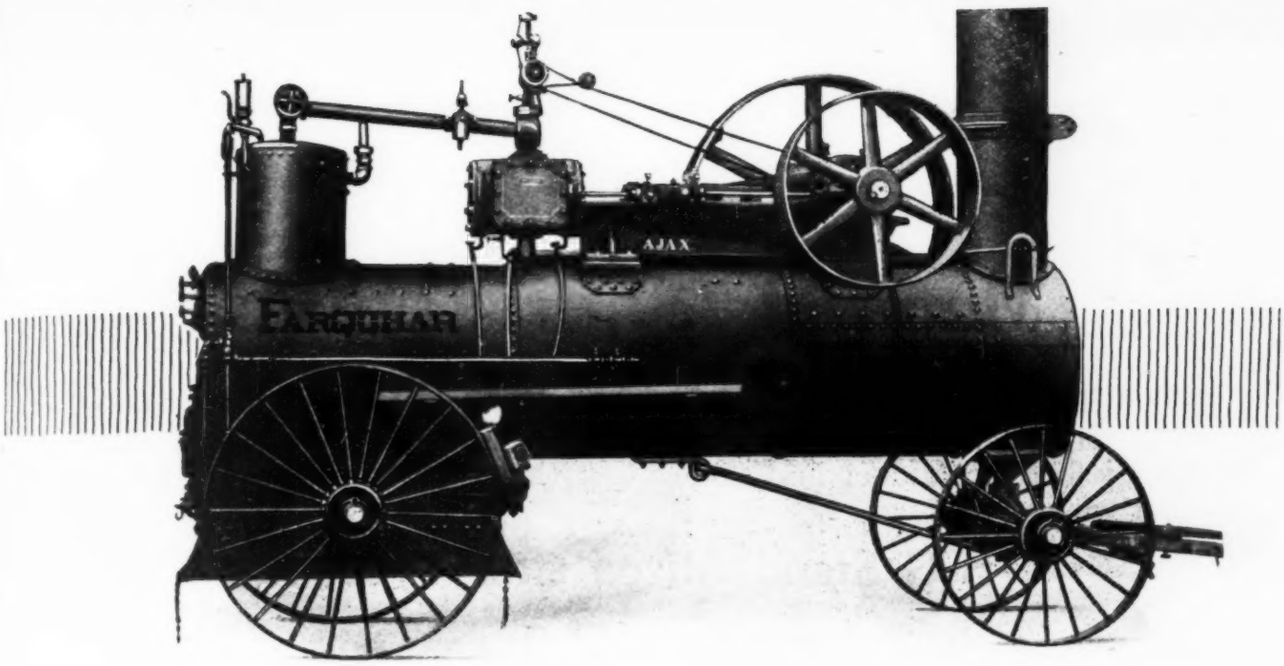

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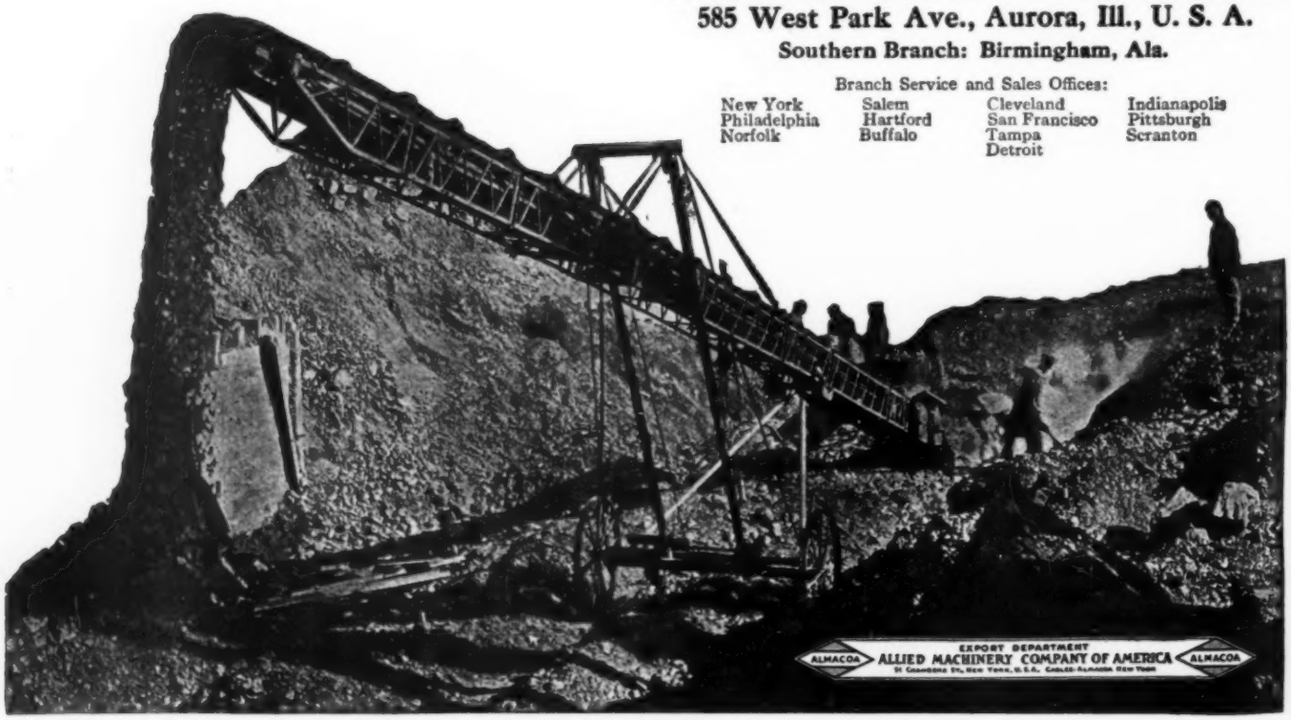

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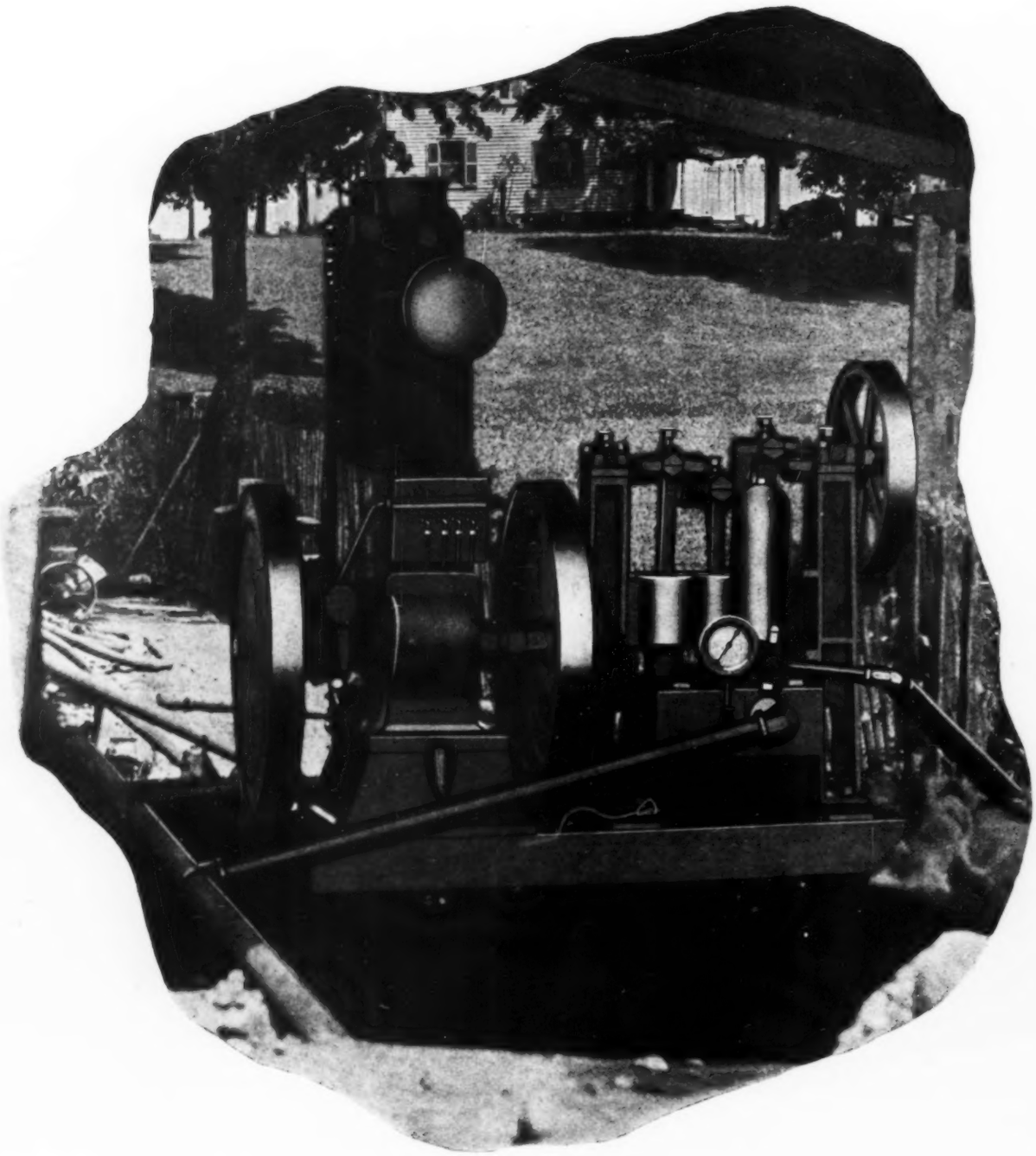

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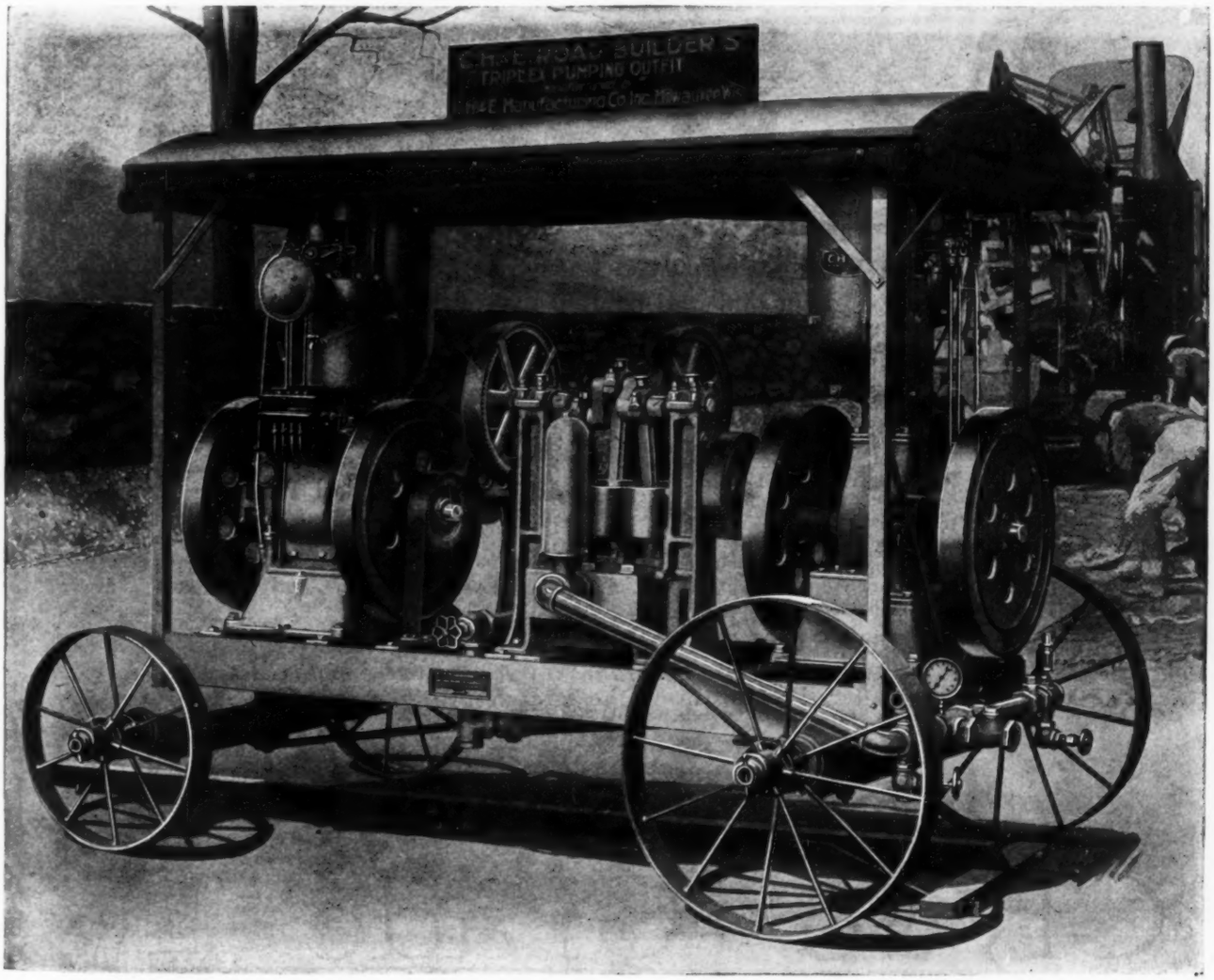

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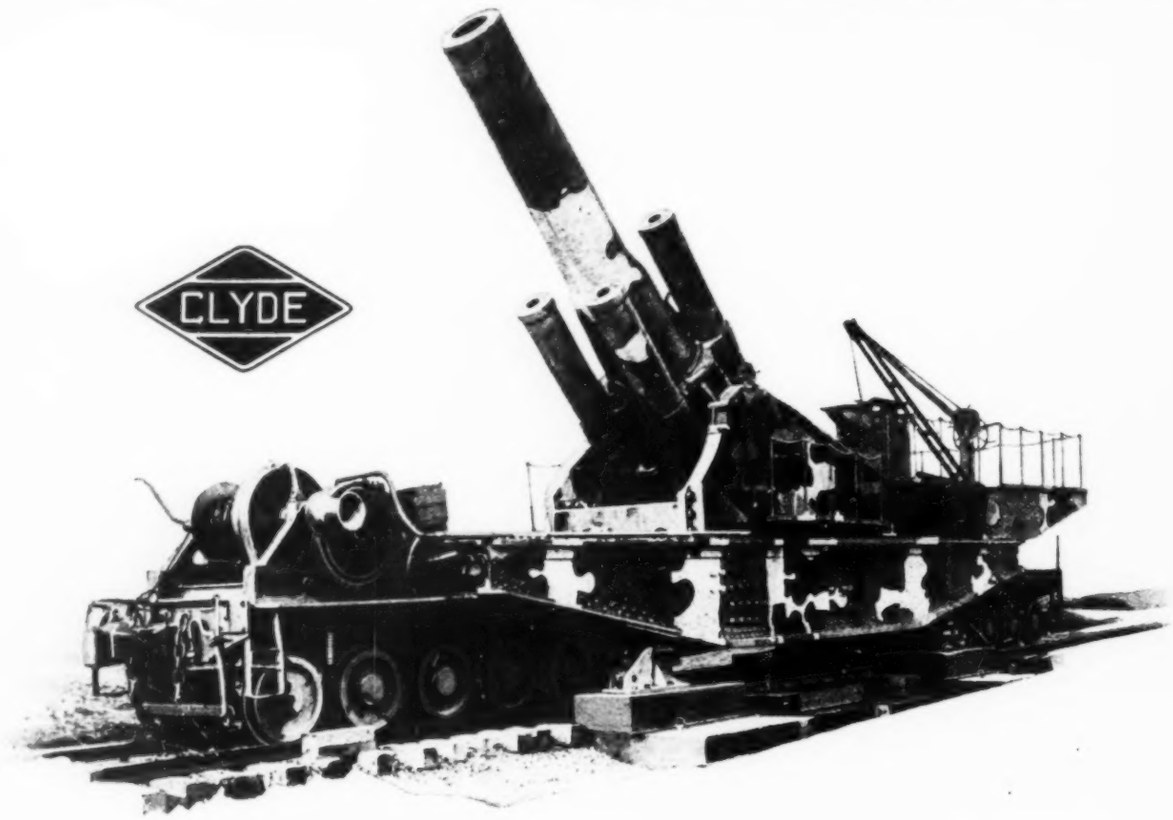

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